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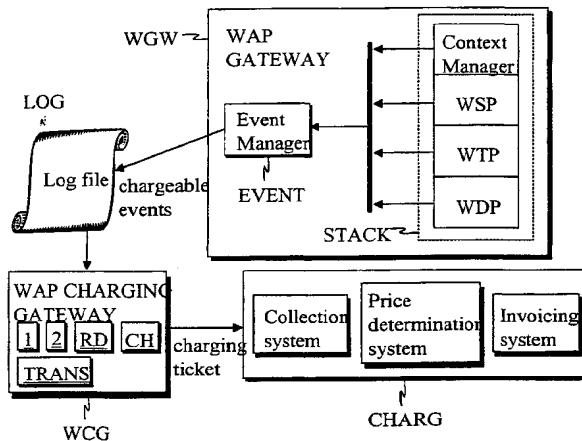
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(54) Title: ARRANGING OF BILLING IN A TELECOMMUNICATION SYSTEM



(57) Abstract: The invention relates to a WAP Charging Gateway (WCG), method and system for arranging a transaction-based billing for WAP services in a telecommunication system comprising a telecommunication network (PLMN); a terminal device (MS) which is connected to the telecommunication network (PLMN) and which is used to use WAP services; a WAP Gateway (WGW) which is connected to the telecommunication network (PLMN); a content provider of WAP services (SERVER) which is connected to the WAP Gateway (WGW); a billing log file (LOG); a transaction manager (EVENT) which writes the transactions associated with the billing, generated from different WAP protocol levels into the billing log file (LOG); and reading devices (RD) for reading the billing log file (LOG). In the method, the transactions associated with the billing, generated from different WAP protocol levels are written into the billing log file (LOG) and the aforementioned transactions are read in the billing log file (LOG). According to the invention, the transactions included in the billing log file (LOG) are changed into a readable form; first rules (1) are determined based on which parameters are stored up of the transactions included in the billing log file; and second rules (2) are determined based on which chargeable transactions are generated from the aforementioned parameters.

WO 01/69891 A1



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

**ARRANGING OF BILLING IN A TELECOMMUNICATION SYSTEM****FIELD OF THE INVENTION**

The present invention relates to telecommunication systems. In particular, the invention relates to a method, system and WAP Charging Gateway for arranging a transaction-based billing for WAP services.

**BACKGROUND OF THE INVENTION**

The use of the wireless application protocol (WAP, Wireless Application Protocol) is becoming common in solutions in which a connection is needed between portable terminal devices, such as mobile stations and Internet applications, e.g. electronic mail, WWW (World Wide Web), news groups. The wireless application protocol provides an architecture which adapts mobile phones, browser programs of mobile phones, and the WWW to work as a functional entity. The HTML language (Hyper Text Mark-up Language) used in the WWW is translated into a WML (Wireless Mark-up Language) designed for the wireless environment, when information is being transmitted to mobile stations. At present, as the description language of the WAP standard, the WML language is used, but the language may be understood to mean also any other description language consistent with the future WAP standard. The wireless application protocol comprises of the following five layers: wireless application environment (WAE, Wireless Application Environment), wireless session layer (WSL, Wireless Session Layer), wireless transaction layer (WTP, Wireless Transaction Layer), wireless transport layer security (WTLS, Wireless Transport Layer Security), and wireless datagram layer (WDP, Wireless Datagram Layer). The wireless application environment is used to mean, e.g. a WTA (WTA, Wireless Telephone Application), or some other suitable environment. Lowermost is yet a system dependant layer

which defines the transfer mode of the information inside the system in question. The specification currently accepted is the WAP specification 1.1. The aforementioned specification and other WAP related 5 specifications are available at the Internet address www.wapforum.com.

The undeniable advantage of a mobile communication network, e.g. a GSM system (GSM, Global System for Mobile communications) as compared with a public 10 switched telephone network (PSTN, Public Switched Telephone Network) is the mobility management. The mobile communication network enables one to make and receive phone calls anywhere in the coverage area of the network. In this application, the mobile communication 15 network is advantageously used to mean a digital mobile network.

Ericsson, Motorola, Nokia and Phone.com founded in 1997 the WAP Forum. The WAP Forum is among 20 other things an open association of terminal manufacturers, operators and different service providers, which anyone can join. One specific objective of the WAP architecture is to enable the use of services provided by the Internet on portable terminals whose data processing capacity, size of display or storage capacity 25 is small or restricted. Terminals as described above are, e.g. mobile stations and PDAs (PDA, Personal Digital Assistant). The WAP specification does not take a stand on the fact of how the air interface is implemented. This enables the fact that several 30 different operators may take advantage of the possibilities provided by the standard.

At present, the utilization of the WAP protocol in mobile stations succeeds, e.g. by means of short messages (SMS, Short Message Service) or by 35 means of a separate switched data connection. In a switched data connection, a connection is established

by the mobile station with a specific number which offers data services.

At present, the billing of WAP services is implemented in such a way that the client is invoiced based on the connection time used by the switched data connection. If the transmission of WAP protocol messages happens by means of short messages, then one SMS-based WAP transaction may require, e.g. five MO oriented (MO, Mobile Originated) and 15 MT oriented (MT, Mobile Terminated) short messages.

The problem with the connection time billing is that the distribution of income gets more difficult. This is used to mean the way of how the distribution of income may be arranged with justice between the service provider and the content provider. In a connection time billing, all the services are of the same price. Connection time cannot be divided between the service provider and the content providers. A similar problem occurs with the SMS-based WAP services. The number of messages used for the WAP service does not tell anything about the content or quality of the service.

#### OBJECTIVE OF THE INVENTION

The objective of the invention is to eliminate the drawbacks referred to above or at least significantly to alleviate them. One specific objective of the invention is to disclose a new type of method, system and device for the arranging of a transaction-based billing for WAP services.

#### BRIEF DESCRIPTION OF THE INVENTION

The present invention relates to telecommunication systems. The invention enables one to implement the pricing of service traffic implemented in accor-

dance with the WAP specification and taken care of by the WAP Gateway on a transaction basis.

The invention relates to the WAP Charging Gateway for arranging a transaction-based billing for 5 WAP services. The WAP Charging Gateway comprises reading devices for reading the billing log file. According to the invention, the WAP Charging Gateway comprises changing facilities for changing the transactions of the billing log file into a readable form, 10 first rules based on which one may store up parameters of the transactions included in the billing log file and second rules based on which one may generate chargeable transactions from the aforementioned parameters.

15 In an embodiment of the invention, the WAP Charging Gateway comprises a transmitter for sending the piece of billing information to the billing system.

Further, the invention relates to a method 20 for the arranging of transaction-based billing for WAP services. In the method, the transactions associated with the billing, generated from different WAP protocol levels are written into the billing log file. The writing happens advantageously in the WAP Gateway. The 25 billing log file is advantageously read in the WAP Charging Gateway.

According to the invention, the aforementioned 30 transactions of the billing log file are changed into a readable form. This is preferably done in the WAP Charging Gateway. For the WAP Charging Gateway, first rules are determined based on which parameters are stored up of the transactions included in the billing log file. One parameter of this kind may be, e.g. the URL address of the chargeable service 35 (URL, Universal Resource Locator). Chargeable transactions are generated from the aforementioned parameters based on predetermined second rules.

The content of the second rules may depend on where the WAP protocol messages are being transported. The second rules are used to determine the events which form the chargeable transaction. The content of 5 the second rules depends on whether the WAP service has been implemented by means of short messages or by means of a data call connection. Further, the content of the second rules depends on whether it is a question about a connectionless or a connection-oriented 10 connection.

In an embodiment of the invention, different error situations or status data of the service are taken into account when generating the rules.

In an embodiment of the invention, the information connected with the same transaction is combined based on a specific identifier, a so-called Event\_Linkage\_Id into a separate billing ticket. The billing ticket generated may be sent further to the 15 billing system to be handled.

20 The invention also relates to the arranging of a transaction-based billing for WAP services in a telecommunication system comprising a telecommunication network, a terminal device which is connected to the telecommunication network and which is used to use the WAP services, a WAP Gateway which is connected to 25 the telecommunication network, a content provider of WAP services which is connected to the WAP Gateway, and a billing log file. The telecommunication network is advantageously used to mean a mobile communication 30 network and the terminal device a mobile station. The system further comprises a transaction manager which writes the transactions associated with the billing, generated from different WAP protocol levels into the billing log file, and reading devices for reading the 35 billing log file. According to the invention, the system comprises a WAP Charging Gateway which comprises changing facilities for changing the transactions in-

cluded in the billing log file into a readable form, first rules based on which one may store up parameters of the transactions included in the billing log file and second rules based on which one may generate 5 chargeable transactions from the aforementioned parameters.

In an embodiment of the invention, the system comprises a billing management system for handling the billing ticket generated.

10 In an embodiment of the invention, the system comprises a transmitter for sending the piece of billing information to a separate billing system.

The present invention enables the offering of WAP services of different prices, accurate reports of 15 the use of services and with this also a flexible distribution of income depending on the amount of use to the content provider. The distribution of income of a service based on the concept of transaction may be implemented to the content provider based on the actual 20 use. Previously one has had to buy the content from the content providers only with permanent contracts. Thanks to the invention, in the distribution of income to the content providers, even very complicated contracts may be used which include both fixed prices and 25 prices based on transactions. The management of WAP transactions enables also an advanced consideration of the QoS (QoS, Quality of Service) both in the price of the service of the end client and in the distribution of income.

30 Furthermore, the present invention provides the advantage that it is independent both of the transmission path of WAP services (data call, SMS) and of the connection mode (connection-oriented, connectionless).

**BRIEF DESCRIPTION OF THE DRAWINGS**

In the following section, the invention will be described in detail by way of examples of its embodiments, in which

5 Fig. 1 is a basic figure illustrating the function of WAP,

Fig. 2 is one advantageous flow chart illustrating the function of the present invention.

10 Fig. 3 is one advantageous example illustrating the function of the present invention.

**BRIEF DESCRIPTION OF THE INVENTION**

Fig. 1 is one basic figure illustrating, by way of example, the architecture connected with the wireless application protocol. The example as shown in Fig. 1 comprises a telecommunication network PLMN, a mobile station MS connected to it, a WAP Gateway WGW and a service management system SERV. In addition, the system comprises a content provider SERVER. The WAP Gateway WGW is connected to the telecommunication network PLMN. Its responsibility is to transform the material provided by the content provider SERVER into a form suitable for the mobile station MS and to transmit the information transformed to the mobile station MS. The traffic between the WAP Gateway WGW and the content provider SERVER is in this example consistent with the HTTP protocol (HTTP, Hyper Text Transport Protocol). The area MAN inside the lined area is in the possession of a mobile operator. By means of the service management system SERV it is possible to control, manage and produce different statistic information relating to the WAP services.

Fig. 2 is a flow chart illustrating the function of the present invention. The WAP Gateway transmitting WAP services is configured in such a way that the billing transactions generated from different WAP

protocol levels are written into the billing log file. The WAP Charging Gateway reads the billing log file and changes the transactions included in it into a readable form, block 20.

5           The WAP Charging Gateway comprises first rules based on which parameters are stored up of the transactions included in the billing log file, block 21. One parameter of this kind is, e.g. the URL address of the chargeable service (URL, Universal Resource Locator). The identifying of the chargeable service is based on the URL address. As shown in block 10 22, second rules are determined based on which chargeable parameters are generated from the aforementioned parameters.

15           Fig. 3 is one advantageous example illustrating the function of the present invention. The system as shown in Fig. 3 comprises a WAP Gateway WGW, a billing log file LOG, a WAP Charging Gateway WCG and a separate billing management system CHARG.

20           In this example the WAP Gateway WGW is a server computer which comprises an event manager EVENT and a WAP protocol STACK. In this connection, only the features of the server computer have been presented that are substantial from the point of view of the invention. The WAP Gateway may comprise also other software components which are not necessary to present in this connection. As a consequence of the functioning of WAP services requested by the mobile station MS the protocols consistent with the protocol stack STACK 25 produce different transactions, as shown in Fig. 1. The event manager EVENT collects the transactions connected with the billing and writes them into a separate billing log file LOG. The billing log file LOG may be a part of the WAP Gateway WGW or alternatively 30 35 a part of the WAP Charging Gateway WCG.

The WAP Charging Gateway WCG comprises reading devices RD for reading the billing log file LOG

and changing facilities CH for changing the transactions included in the billing log file into a readable form.

The WAP Charging Gateway WCG reads the billing log file LOG and changes the transactions included in it into a readable form. There are two sets of rules determined in the WAP Charging Gateway WCG. The responsibility of the first set of rules 1 is to formulate the rules based on which certain parameters are stored up of the transactions included in the billing log file LOG. Further there is a second set of rules 2 determined based on which chargeable transactions are generated from the aforementioned parameters.

The content of the second set of rules 2 depends on where the WAP protocol messages are being transported, i.e. on the fact of whether the WAP service has been implemented by means of short messages or by means of a data call connection. Further, the content of the second set of rules 2 depends on whether it is a question about a connectionless or a connection-oriented connection. In addition, the rules take into account different error situations or status data of service. In this connection, only the features of the WAP Charging Gateway WCG have been presented that are substantial from the point of view of the invention. The WAP Charging Gateway may comprise also other software components which are not necessary to present in this connection.

The following table presents chargeable transactions in the WAP Gateway WGW.

WDP_PRIM_TXD_UP_STACK_SUCCESS	The WDP layer successfully transmitted a Tdunit-Data.Ind primitive to a upper protocol layer.
CM_HTTP_RQ	The Context Manager has made a HTTP Request:

CM_HTTP_RESP	The Context Manager has received a response from the network.
WDP_DATAGRAM_TXD_BEARER_FAIL	The WDP failed in sending the datagram into the network.
CM_ENCODING_FAILED	The translator failed in translating the WMLScript into a binary form.
CM_REQUEST_FAILED	A general transaction which means the failure of a request.
CM_WSP_PRIMITIVE_GEN	The Context Manager has generated a WSP service primitive.
WDP_DATAGRAM_TXD_BEARER	The WDP successfully transmitted the datagram into the network.

The following table presents the correspondence of the parameters of the transactions and of the attributes of the billing ticket to be generated. Information is not collected of all the chargeable transactions, but their occurrence is, however, registered.

	Trans- action						
Attribute of the ticket	WDP_PRIM_TXD _UP_STACK_SU CCESS	CM_HTTP_ RESP	WDP_DATAGRAM _TXD_BEARER_ FAIL	CM_REQUEST_ FAILED	CM_WSP_ PRIMITIVE_ GEN	WDP_DATAGRAM _TXD_BEARER	
EVENT_LINK AGE_ID	elid						

BATCH_SEQUENCE						
USER_MSISDN		msisdn			msisdn	
USER_IMSI						
SERVICE_ADDRESS	destination_address					
SERVICE_STATUS	Ok	ok/ fail	fail	fail		
CONTENT_ADDRESS		url			url	
SERVICE_START TIME	time					
SERVICE_END TIME			time	time		time
MESSAGES_SENT						sms
MESSAGES_RECEIVED	sms					
BYTES_SENT					content_length	
BYTES RECEIVED	content_length					
TICKET_COMPLETE			x	x	x	x
EVENT_MASK	x	x	x	x	x	x

In a typical successful WAP service transaction when using a connectionless connection, the following transactions are typically generated into the  
5 log file:

WDP\_PRIM\_TXD\_UP\_STACK\_SUCCESS (The WDP level of the WAP Gateway acknowledges the receipt of the service request from the WAP terminal device)

CM\_HTTP\_RQ (The Context Manager of the WAP Gateway sends a HTTP request to the server)

CM\_HTTP\_RESP (The Context manager receives a HTTP response to the service request)

CM\_WSP\_PRIMITIVE\_GEN (The HTTP response has been changed to the WSP level of the WAP protocol)

WDP\_DATAGRAM\_TXD\_BEARER (The WDP level has successfully sent a response along the transmission path.)

In a connection-oriented connection, the first transaction is left out. In it, the first transaction has got a different Event\_Linkage\_Id than the other transactions.

CM\_HTTP\_RQ

CM\_HTTP\_RESP

CM\_WSP\_PRIMITIVE\_GEN

WDP\_DATAGRAM\_TXD\_BEARER

5

The WAP Charging Gateway WCG generates a billing ticket every time there are new transactions to handle, with the elid attribute value (EVENT\_LINKAGE\_ID) of which there are no open billing tickets to be found (TICKET\_COMPLETE = 0). For an open billing ticket, there are still new transactions to be expected.

In the following table, a list of the update rules of the attributes of the ticket are shown:

15

USER_MSISDN	If this attribute of the ticket has got a value, nothing is done.  If there is no value, then it is taken from the MSISDN field of the transaction, if the field can be found.
SERVICE_ADDRESS	If this attribute of the ticket has got a value, nothing is done

	Otherwise, if the transaction was WDP_PRIM_TXD_UP_STACK_SUCCESS, the value is taken from the DESTINATION_ADDRESS parameter.
SERVICE_STATUS	The value is taken from the STATUS parameter.
CONTENT_ADDRESS	If this attribute of the ticket has got a value, nothing is done  Otherwise the value is taken from the URL parameter of the value, if it exists.
SERVICE_START_TIME	If this attribute of the ticket has got a value, nothing is done.  Otherwise the value is taken from the TIME parameter of the value, if it exists.  The value of the attribute SERVICE_START_TIME of the ticket will be the time stamp of the first transaction of the ticket. This is necessarily not relevant to the fact of when the service from the point of view of the service user began.
SERVICE_END_TIME	The value of the attribute is updated with the value of the TIME parameter of each ticket to be handled.  The outcome is that the value of the attribute-END_TIME of the ticket will remain the time stamp of the last transaction of the ticket.
MESSAGES_SENT	The value is taken from the SMS pa-

	parameter of the WDP_DATAGRAM_TXD_BEARER transaction.
MESSAGES_RECEIVED	The value is taken from the SMS parameter of the WDP_PRIM_TXD_UP_STACK_SUCCESS transaction.
BYTES_SENT	The value is taken from the CONTENT_LENGTH parameter of the CM_WSP_PRIMITIVE_GEN transaction.
BYTES RECEIVED	The value is taken from the CONTENT_LENGTH parameter of the WDP_PRIM_TXD_UP_STACK_SUCCESS transaction.
EVENT_MASK	In this attribute, a record is kept of what transactions have already been handled for this ticket. The value of the attribute is updated on each transaction, but the value does not depend on the parameters of the transaction but solely on the ID of the transaction.

The ticket is completed when its SERVICE\_END\_TIME is older than the time stamp of the transaction last read in the billing log file LOG of the WAP Gateway WGW, and in addition, when the transactions CM\_WSP\_PRIMITIVE\_GEN and WDP\_DATAGRAM\_TXD\_BEARER or WDP\_DATAGRAM\_TXD\_BEARER or CM\_REQUEST FAILED can be found in the ticket. The WAP Charging Gateway WCG comprises a transmitter TRANS for sending the piece of billing information to a separate billing system which transmitter TRANS is used to transfer the completed billing tickets further to the billing management system CHARG, in which the amount of the invoice is determined and in which the user is charged for the service used by him or her. The billing ticket generated describes the function of the WAP

service in such a way that based on the billing ticket, the billing and distribution of income may be carried out.

The invention is not restricted merely to the examples of its embodiments referred to above, instead many variations are possible within the scope of the inventive idea defined by the claims.

**CLAIMS**

1. A WAP Charging Gateway (WCG) for arranging a transaction-based billing for WAP services which WAP Charging Gateway comprises reading devices (RD) for 5 reading the billing log file (LOG);

characterized in that the WAP Charging Gateway (WCG) further comprises:

changing facilities (CH) for changing the transactions included in the billing log file (LOG) into a 10 readable form;

first rules (1) based on which parameters may be stored up of the transactions included in the billing log file (LOG);

second rules (2) based on which chargeable trans- 15 actions may be generated from the aforementioned pa-rameters.

2. A WAP Charging Gateway (WCG) according to claim 1, characterized in that the WAP Charging Gateway (WCG) comprises a transmitter (TRANS) 20 for sending the piece of billing information to the billing system.

3. A method for arranging a transaction-based billing for WAP services which method comprises the steps of:

25 writing the transactions associated with the billing, generated from different WAP protocol levels in the billing log file;

reading the aforementioned transactions in the billing log file;

30 characterized in that the method further comprises the steps of:

changing the aforementioned transactions of the billing log file into a readable form;

determining first rules based on which parameters 35 are stored up of the aforementioned transactions included in the billing log file; and

determining second rules based on which chargeable transactions are generated from the aforementioned parameters.

4. A method according to claim 3, characterized in that the transactions associated with the billing, generated from different WAP protocol levels are written in the billing log file in the WAP Gateway.

5 5. A method according to claim 3 or 4, characterized in that the aforementioned transactions are read in the billing log file in the WAP Charging Gateway.

10 6. A method according to any one of the preceding claims 3, 4 or 5, characterized in that the generation of the second rules is set to be dependent on where the WAP protocol messages are being transported.

15 7. A method according to any one of the preceding claims 3, 4, 5 or 6, characterized in that the generation of the second rules is set to be dependent on whether it is a question about a connection-oriented or connectionless connection.

20 8. A method according to any one of the preceding claims 3, 4, 5, 6 or 7, characterized in that different error situations or status data of service are taken into account in the generation of the rules.

25 9. A method according to any one of the preceding claims 3, 4, 5, 6, 7 or 8, characterized in that information relating to the same transaction is combined into a separate billing ticket based on a specific identifier.

30 10. A method according to any one of the preceding claims 3, 4, 5, 6, 7, 8 or 9, characterized in that the billing ticket generated is sent further to the billing system to be handled.

11. A system for arranging a transaction-based billing for WAP services in a telecommunication system comprising:

- a telecommunication network (PLMN);
- 5 a terminal device (MS) which is connected to the telecommunication network (PLMN) and which is used to use WAP services;
- a WAP Gateway (WGW) which is connected to the telecommunication network (PLMN);
- 10 a content provider of WAP services (SERVER) which is connected to the WAP Gateway (WGW);
- a billing log file (LOG);
- 15 an event manager (EVENT) which writes the transactions associated with the billing, generated from different WAP protocol levels in the billing log file (LOG);
- reading devices (RD) for reading the billing log file (LOG) ;
- 20 characterized in that the system further comprises :
  - a WAP Charging Gateway (WCG) which comprises:
    - changing devices (CH) for changing the transactions of the billing log file (LOG) into a readable form;
  - 25 first rules (1) based on which parameters may be stored up of the transactions included in the billing log file (LOG); and
  - second rules (2) based on which chargeable transactions may be generated from the aforementioned parameters.
- 30 12. A system according to claim 11, characterized in that the system comprises a billing management system (CHARG) for handling the billing ticket generated.
- 35 13. A system according to claim 11 or 12, characterized in that the system comprises a

transmitter (TRANS) for sending the piece of billing information to the billing system (CHARG).

14. A system according to any one of the preceding claims 11, 12 or 13, characterized in  
5 that the telecommunication network (PLMN) is a mobile communication network.

15. A system according to any one of the preceding claims 11, 12, 13 or 14, characterized in that the terminal device (MS) is a mobile station.

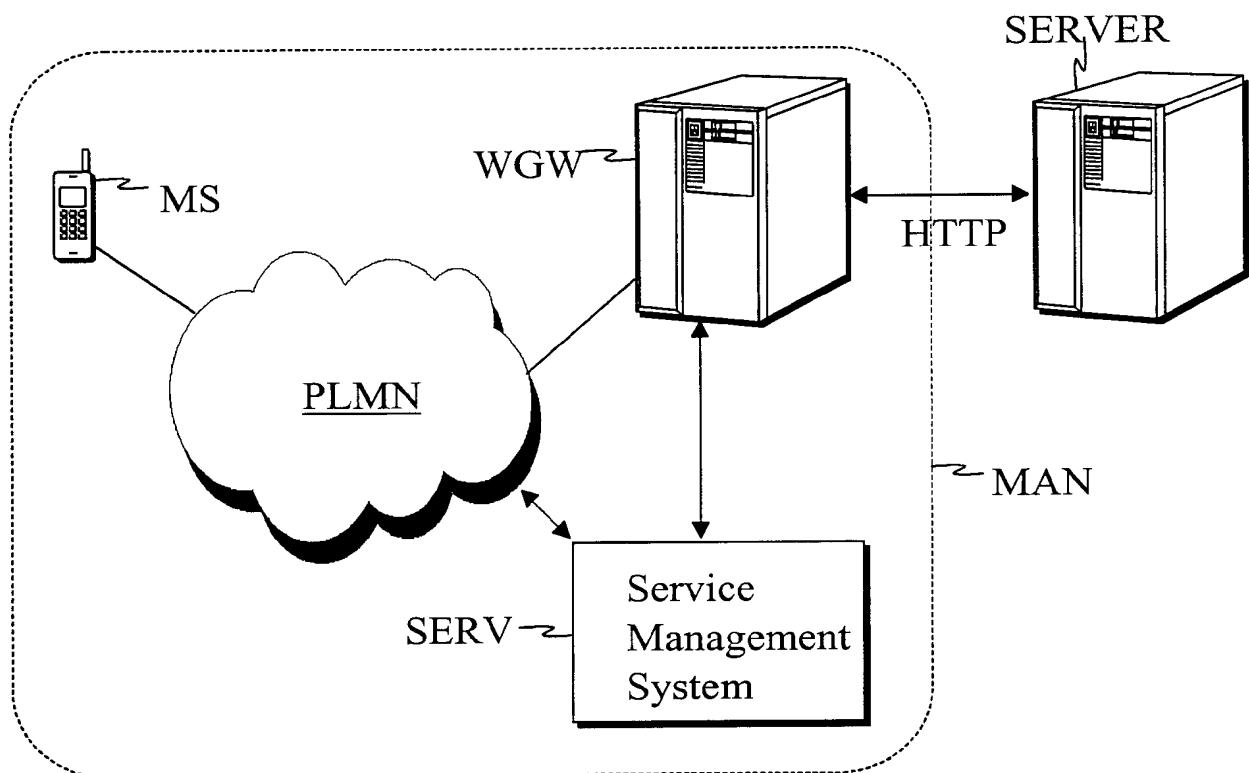


Fig. 1

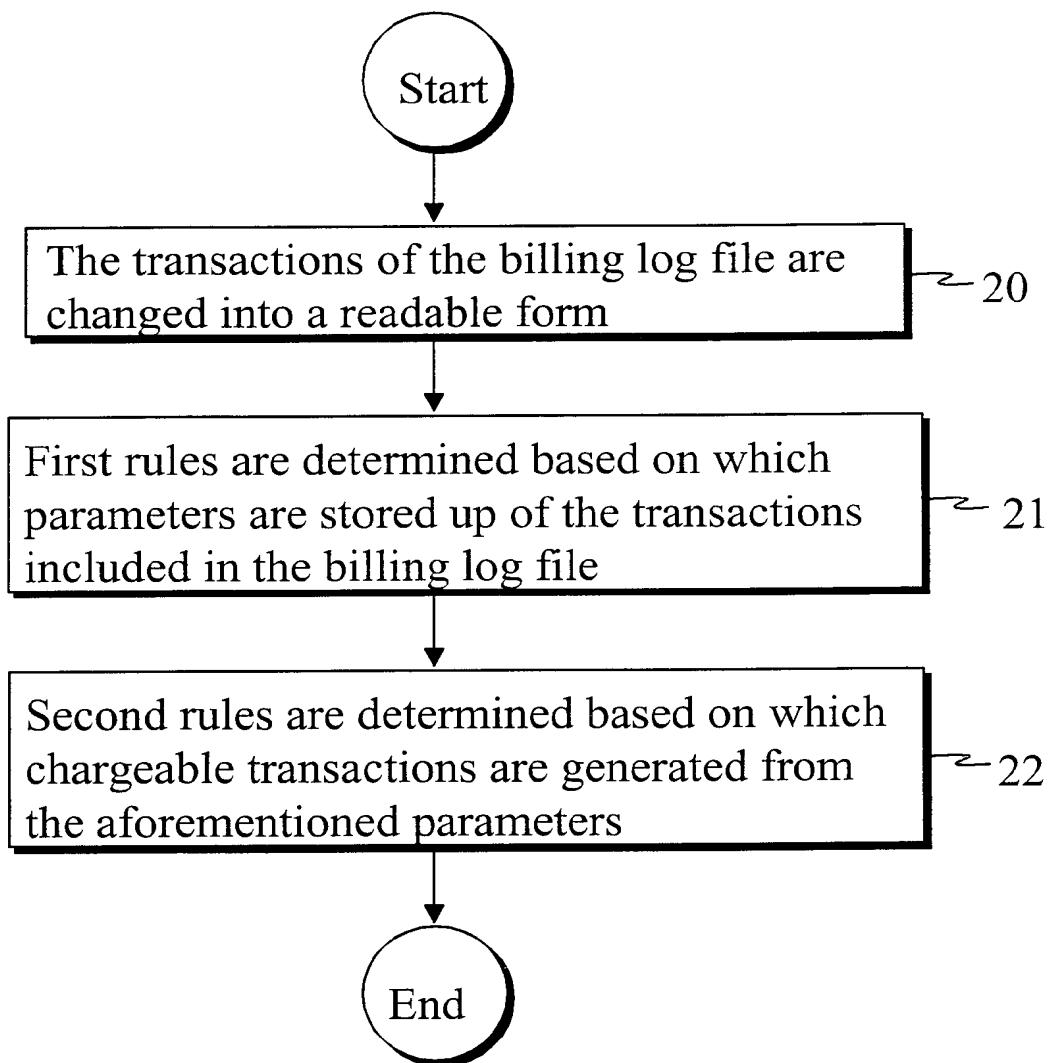


Fig. 2

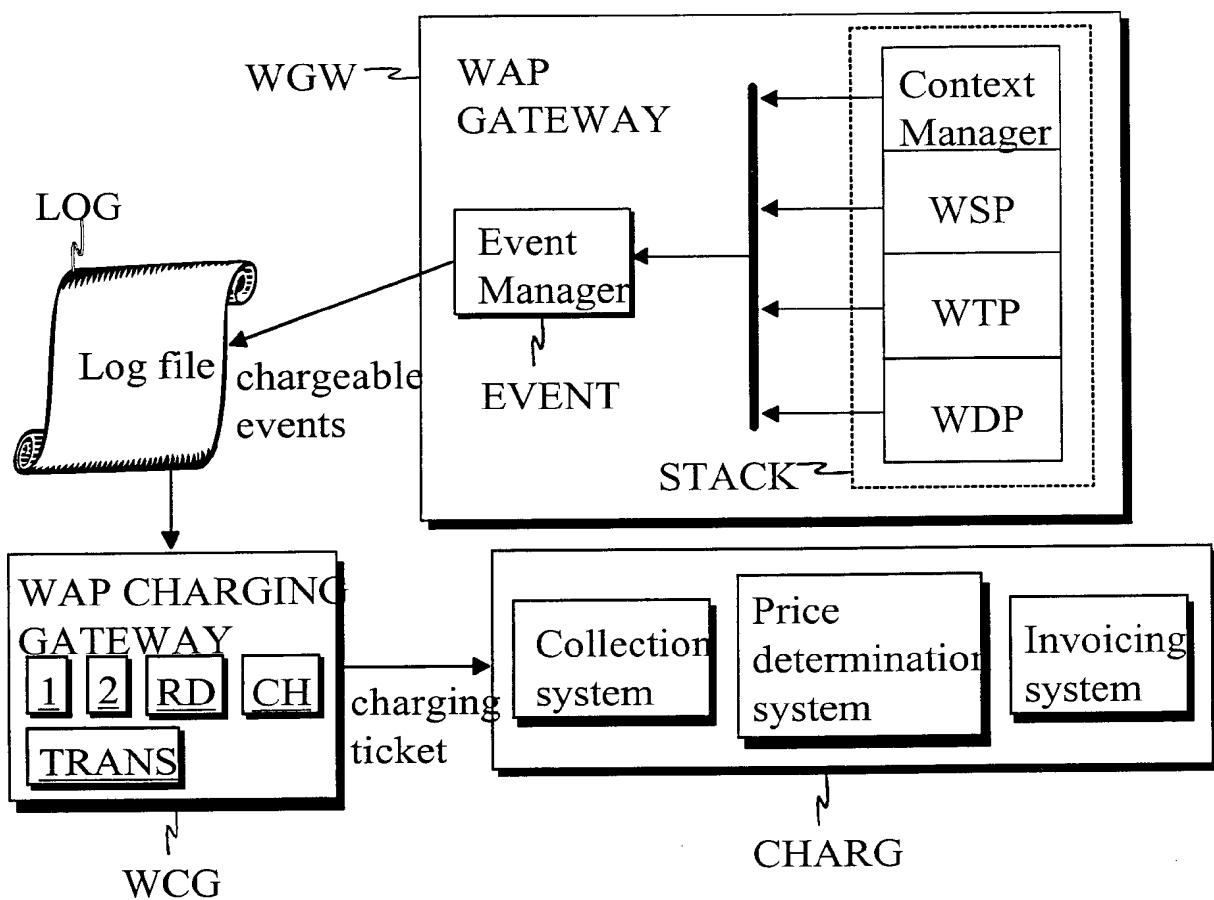


Fig. 3

## INTERNATIONAL SEARCH REPORT

International application No.

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## A. CLASSIFICATION OF SUBJECT MATTER

**IPC7: H04L 29/08, H04L 12/66, H04L 12/14**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC7: H04L, H04Q, H04M**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**SE,DK,FI,NO classes as above**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**WPI, EPO INTERNAL**

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 0046963 A1 (APION TELECOMS LIMITED), 10 August 2000 (10.08.00), figures 1,2, claims 1-46  --	1-15
A	MURPHY, DENIS: The Mobile Economy Becomes a Reality. November 1999. <a href="http://www.telecommagazine.com/199911/tci/mobile.html">www.telecommagazine.com/199911/tci/mobile.html</a>  --	1-15
A	WO 9933034 A1 (GLOBAL MOBILITY SYSTEMS, INC.), 1 July 1999 (01.07.99), claims 26-48  --	1-15
A	WO 9945684 A2 (NOKIA MOBILE PHONES LTD.), 10 Sept 1999 (10.09.99), Abstract and claims  --	1-15

 Further documents are listed in the continuation of Box C. See patent family annex.

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31 July 2001

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01-08-2001

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